Multinationality and Downside Risk:
The Contingent Roles of Option Portfolio Characteristics and Organizational Factors

René Belderbos
University of Leuven, Belgium
UNU-MERIT, Maastricht
Maastricht University

Tony W. Tong
University of Colorado

Shubin Wu
Katholieke Universiteit Leuven
Northeastern University of China

KATHOLIEKE UNIVERSITEIT LEUVEN

University of Colorado at Boulder
Colorado LEEDS
School of Business

Research Questions

- Under what conditions does multinationality (= manufacturing operations in multiple countries) provide firms greater effective flexibility to respond to (cost) shocks, reducing 'downside risk' (=mitigating negative earnings effects)

- What factors shape the multinationality—downside risk relationship?

Multinationality → Downside Risk

↑

Contingencies?
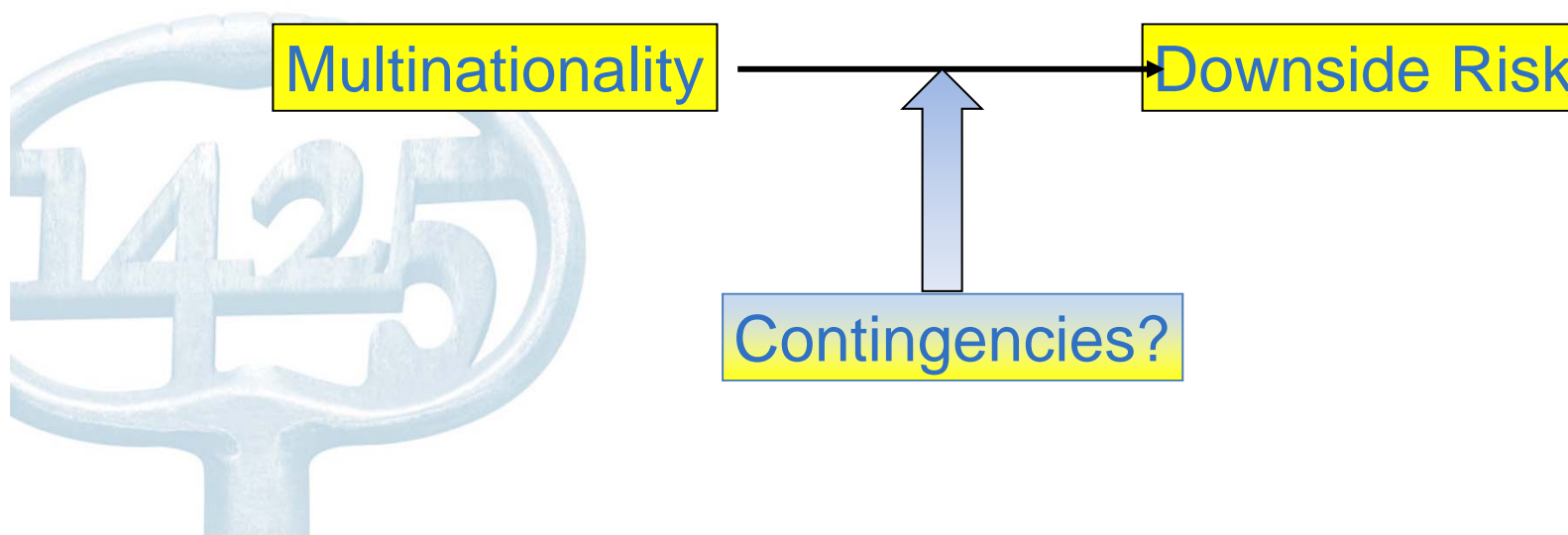
Theoretical Background

- **Real options theory**
  - Switching options in MNCs allow the firms to shift value chain activities across their networks of international operations in response to changes in factor and product market conditions in different countries (Kogut 1983, Kogut & Kulatilaka 1994)
  - Firms that have invested in a 'porfolio' of affiliates: have a portfolio of switch options that is valuable under macroeconomic uncertainty. They can exercise these options in case of macroeconomic shocks and divergence
  - ➢ MNCs can therefore enjoy operating flexibility and reduce downside risk (Huchzermeier & Cohen 1996, Dasu & Li 1997)
- **Empirical findings: mixed**
  - Multinational investment reduces MNCs' economic exposure to foreign exchange rate movements, but multinationality is not associated with lower downside risk (Reuer & Leiblein 2000)
  - The relationship between downside risk and multinationality is U-shaped, and downside risk is also affected by characteristics of the affiliate portfolio (Tong & Reuer 2007)

Prior research applying option theory assumes that:

- Increased multinationality provides the MNC with more valuable opportunities for shifting value chain activities
- The MNC's internal organization allows it to effectively coordinate its geographically dispersed affiliates to leverage the potential shifting opportunities

Contribution of our paper:

- Explicit consideration of real options theory's assumptions and boundary conditions in its applications to MNCs:
- *External environment:*

  - Is there scope for production shifting within the portfolio of affiliates?
    - ➢ Correlation in real labor cost in the MNCs' host countries (*portfolio sub-additivity*)

- *Organizational factors (control and coordination)*

  - Firms need to be able to exercise the options and reap the benefits of the switching opportunities: this requires global coordination and control over affiliates
    - ➢ Equity share in the portfolio of affiliates; expatriate assignments in overseas affiliates 4

- The value of the individual options [e.g., $V(A)$, $V(B)$] in an option portfolio may not be fully additive: $V(A,B) < V(A) + V(B)$

- Such "subadditivity" can be observed within the MNC's option (affiliate) portfolio, due to potential correlations in input cost conditions across the host countries (Belderbos & Zou 2009)

- The greater the subadditivity within the MNC's option portfolio, the smaller the contribution of the individual option to the portfolio's switching option value, and thus the weaker the impact of increased multinationality on downside risk reduction

Source of Subadditivity

- Input cost conditions
  - MNCs are well positioned to exploit imperfect correlations in input cost in different home countries (Kogut & Kulatilaka 1994)
  - Real labor cost is one of the major cost elements in multinational manufacturing (Kouvelis *et al*. 2001), but real labor costs in different host countries may be highly correlated (Belderbos & Zou 2009)

- *H1: The negative impact of multinationality on downside risk is stronger for firms with a less subadditive option portfolio (i.e., firms operating in host countries with relatively low correlations in labor costs).*

Organizational factors (I)

- **Subsidiary ownership and control**
  - The degree to which an MNC can achieve flexibility and downside risk reduction depends on the distribution of incentives and control throughout the firm's network of affiliates
  - Due to shared ownership and the often disparate incentives between the partners, affiliates with lower equity stake are less able to respond swiftly to environmental changes compared to affiliates with higher equity stake.
  - The MNC needs to maintain a high degree of control over its affiliates to effectively coordinate the operations (Belderbos & Zou 2007, Tong & Reuer 2007); such coordination is more attainable when there are affiliates with higher equity stake in the firm's affiliate portfolio

- ***H2a****: The negative impact of multinationality on downside risk is stronger, the greater the firm's equity share in its portfolio of foreign affiliates.*
- ***H2b:*** *The moderating effect of equity share on the relationship between multinationality and downside risk in H2a will be greater for firms with a less subadditive option portfolio.*

Organizational factors (II)

Expatriate assignment

- Prior conceptual work has emphasized the importance of HRM systems for MNCs to coordinate dispersed affiliates and achieve operating flexibility(Kogut 1985, Kogut & Kulatilaka 1994)
- The assignment of expatriates to an affiliate helps to ensure that the way the affiliate is managed is in line with the interest of the parent company (O'Donnell 2000, Belderbos & Heijltjes 2005)
- Greater assignment of expatriates in overseas affiliates can strengthen the MNC's control and coordination of its network of multinational operations, so that the switching options will be managed consistent with the firm's global interest

- ***Hy3a:*** *The negative impact of multinationality on downside risk is stronger, the greater the firm's assignment of expatriates in its portfolio of foreign affiliates.*
- ***H3b:*** *The moderating effect of expatriate assignment on the relationship between multinationality and downside risk in H3a will be greater for firms with a less subadditive option portfolio.*

Sample and Data

- **Sample**
  - 1,010 Japanese publicly-listed MNCs that operated at least one overseas manufacturing affiliate during 1985-2006
  - 10,799 firm-year observations for the time window 1990-2006; we used a five-year time window (1985-1989) in order to calculate the dependent variable *Downside Risk*
  - Panel dataset for the period 1990-2006
- **Data sources**
  - FDI information: "*Directory of Overseas Affiliates*" published by Toyo Keizai
  - Financial information: Development Bank of Japan
  - Host country variable measurement: various data sources such as World Bank, ILO
- **Methods**
  - Fixed effects panel estimator: control for unobserved firm heterogeneity: examine 'within variation' in firm performance
  - Split sample tests for H2b and H3b: estimate separate models for low and high sub-additivity affiliate portfolios

Variables and Measurements

- Dependent variable: performance (ROA) deviation from industry mean

$$\textbf{\textit{Downside Risk}}_{t=0} = \sqrt{\frac{1}{5} \sum_{t=0}^{t=-4} (\text{IROA}_{t-1} - \text{ROA}_t)^2 \,\Big|\, \text{IROA}_{t-1} > \text{ROA}_t}$$

- Independent variables
  - *Multinationality*: # of host countries in which the MNC operates manufacturing affiliates
  - Sub-additivity*: Correlation* in real labor cost: average past 5-year correlation between the annual dollar manufacturing wages of the host countries
  - *Equity stake*: the Japanese firm's average equity stake in its portfolio of foreign manufacturing affiliates.
  - *Expatriate Ratio*: the average expatriate ratio in the firm's manufacturing affiliates
- Control variables
  - *Export Intensity*, *Firm Size*, organizational *Slack*, *Tobin's q, product diversity, International Experience, time dummies*

Table 1 Numbers of Firms and Foreign Affiliates by Industry

Industry	Number of Firms		Number of Affiliates	
	1990	2006	1990	2006
1 Foods and tobacco	33	68	110	273
2 Textiles	15	38	53	269
3 Wood and wood products	0	4	0	6
4 Pulp, paper, and paper products	7	14	16	56
5 Printing	0	8	0	48
6 Chemicals	42	117	188	651
7 Petroleum refining	0	1	0	1
8 Rubber products	7	16	36	111
9 Ceramics, stone, and clay products	16	33	65	226
10 Iron and steel	16	25	56	118
11 Non-ferrous metals	16	25	99	239
12 Fabricated metals	8	37	19	70
13 General machinery	45	120	147	588
14 Electrical machinery	69	145	326	910
15 Transport equipment	26	99	190	935
16 Precision instruments	14	30	36	108
17 Miscellaneous	11	57	18	226
Total	325	837	1,359	4,835

Table 2 Number of Foreign Affiliates by Region

Region / Country	1990	2006
Asia	806	3619
China	34	1438
Taiwan	156	297
Thailand	161	527
Europe	151	448
North America	294	607
United States	247	527
South America	64	90
Africa	11	13
Oceania	33	58
Total	1,359	4,835

Table 3 Descriptive Statistics
Panel A: Full sample(N=10,799)

Panel A: Full Sample (N=10,799)

	Variables	Mean	Std. Dev.	Min.	Max.
1	Downside Risk	1.722	2.892	0.000	63.353
2	Export Intensity	0.088	0.142	0.000	0.987
3	Firm Size	0.321	0.939	0.002	23.148
4	Organizational Slack	0.365	0.142	0.023	2.061
5	Tobin's q	1.326	0.468	0.421	5.138
6	Product Diversity	1.438	1.074	0.000	8.000
7	International Experience	9.536	6.530	0.000	80.333
8	Multinationality	3.466	3.427	0.000	30.800
9	Equity Share	0.578	0.279	0.000	1.000
10	Expatriate Ratio	0.071	0.120	0.000	1.000
11	Cost Subadditivity	0.259	0.346	-0.916	0.997

Panel B: High Cost Subadditivity Subsample (N=5,399)

	Variables	Mean	Std. Dev.	Min.	Max.
1	Downside Risk	1.397	2.110	0.000	36.417
2	Export Intensity	0.114	0.160	0.000	0.983
3	Firm Size	0.458	1.080	0.004	23.148
4	Organizational Slack	0.359	0.134	0.031	1.016
5	Tobin's q	1.355	0.431	0.421	5.061
6	Product Diversity	1.821	1.106	0.200	8.000
7	International Experience	10.220	5.019	0.000	68.667
8	Multinationality	4.926	3.382	0.400	30.800
9	Equity Share	0.645	0.188	0.079	1.000
10	Expatriate Ratio	0.078	0.104	0.000	1.000
11	Cost Subadditivity	0.543	0.241	0.162	0.997

Panel C: Low Cost Subadditivity Subsample (N=5,400)

	Variables	Mean	Std. Dev.	Min.	Max.
1	Downside Risk	2.046	3.473	0.000	63.353
2	Export Intensity	0.063	0.116	0.000	0.987
3	Firm Size	0.184	0.747	0.002	19.332
4	Organizational Slack	0.371	0.149	0.023	2.061
5	Tobin's q	1.298	0.500	0.422	5.138
6	Product Diversity	1.055	0.888	0.000	8.000
7	International Experience	8.853	7.691	0.000	80.333
8	Multinationality	2.007	2.791	0.000	30.800
9	Equity Share	0.511	0.333	0.000	1.000
10	Expatriate Ratio	0.064	0.133	0.000	1.000
11	Cost Subadditivity	-0.025	0.138	-0.916	0.162

Table 4 Correlations
Panel A: Full sample(N=10,799)

	Variables	1	2	3	4	5	6	7	8	9	10
1	Downside Risk	1.000									
2	Export Intensity	0.012	1.000								
3	Firm Size	-0.045	0.141	1.000							
4	Organizational Slack	0.194	0.202	0.079	1.000						
5	Tobin's q	-0.027	0.201	-0.005	0.128	1.000					
6	Product Diversity	-0.083	0.072	0.339	-0.043	-0.074	1.000				
7	International Experience	0.012	-0.007	0.106	0.079	-0.077	0.170	1.000			
8	Multinationality	-0.097	0.147	0.580	-0.016	-0.032	0.642	0.220	1.000		
9	Equity Share	0.028	0.145	0.021	0.126	0.013	0.244	0.253	0.195	1.000	
10	Expatriate Ratio	-0.014	-0.078	-0.038	0.062	-0.005	0.042	-0.024	-0.015	0.283	1.000
11	Cost Subadditivity	-0.099	0.174	0.082	-0.039	0.107	0.254	0.067	0.277	0.187	0.047

	Variables	1	2	3	4	5	6	7	8	9	10
1	Downside Risk	1.000									
2	Export Intensity	0.036	1.000								
3	Firm Size	-0.041	0.146	1.000							
4	Organizational Slack	0.095	0.254	0.132	1.000						
5	Tobin's q	-0.102	0.169	-0.032	0.117	1.000					
6	Product Diversity	-0.078	0.014	0.299	-0.045	-0.093	1.000				
7	International Experience	-0.013	-0.028	0.113	0.077	-0.086	0.041	1.000			
8	Multinationality	-0.098	0.111	0.572	0.022	-0.070	0.508	0.194	1.000		
9	Equity Share	0.067	0.166	-0.080	0.142	0.096	-0.126	0.044	-0.099	1.000	
10	Expatriate Ratio	-0.032	-0.122	-0.082	0.069	0.019	-0.083	-0.127	-0.141	0.138	1.000
11	Cost Subadditivity	-0.016	0.046	-0.128	0.010	0.134	-0.120	-0.059	-0.267	0.029	0.020

	Variables	1	2	3	4	5	6	7	8	9	10
1	Downside Risk	1.000									
2	Export Intensity	0.034	1.000								
3	Firm Size	-0.024	0.065	1.000							
4	Organizational Slack	0.248	0.173	0.033	1.000						
5	Tobin's q	0.022	0.234	0.006	0.143	1.000					
6	Product Diversity	-0.028	0.002	0.334	-0.013	-0.116	1.000				
7	International Experience	0.039	-0.027	0.086	0.089	-0.084	0.239	1.000			
8	Multinationality	-0.028	0.029	0.596	-0.019	-0.061	0.688	0.213	1.000		
9	Equity Share	0.054	0.081	0.036	0.144	-0.049	0.408	0.307	0.258	1.000	
10	Expatriate Ratio	0.003	-0.062	-0.012	0.062	-0.027	0.130	0.020	0.048	0.345	1.000
11	Cost Subadditivity	-0.011	0.063	0.084	-0.035	0.064	0.019	-0.014	0.115	-0.076	-0.027

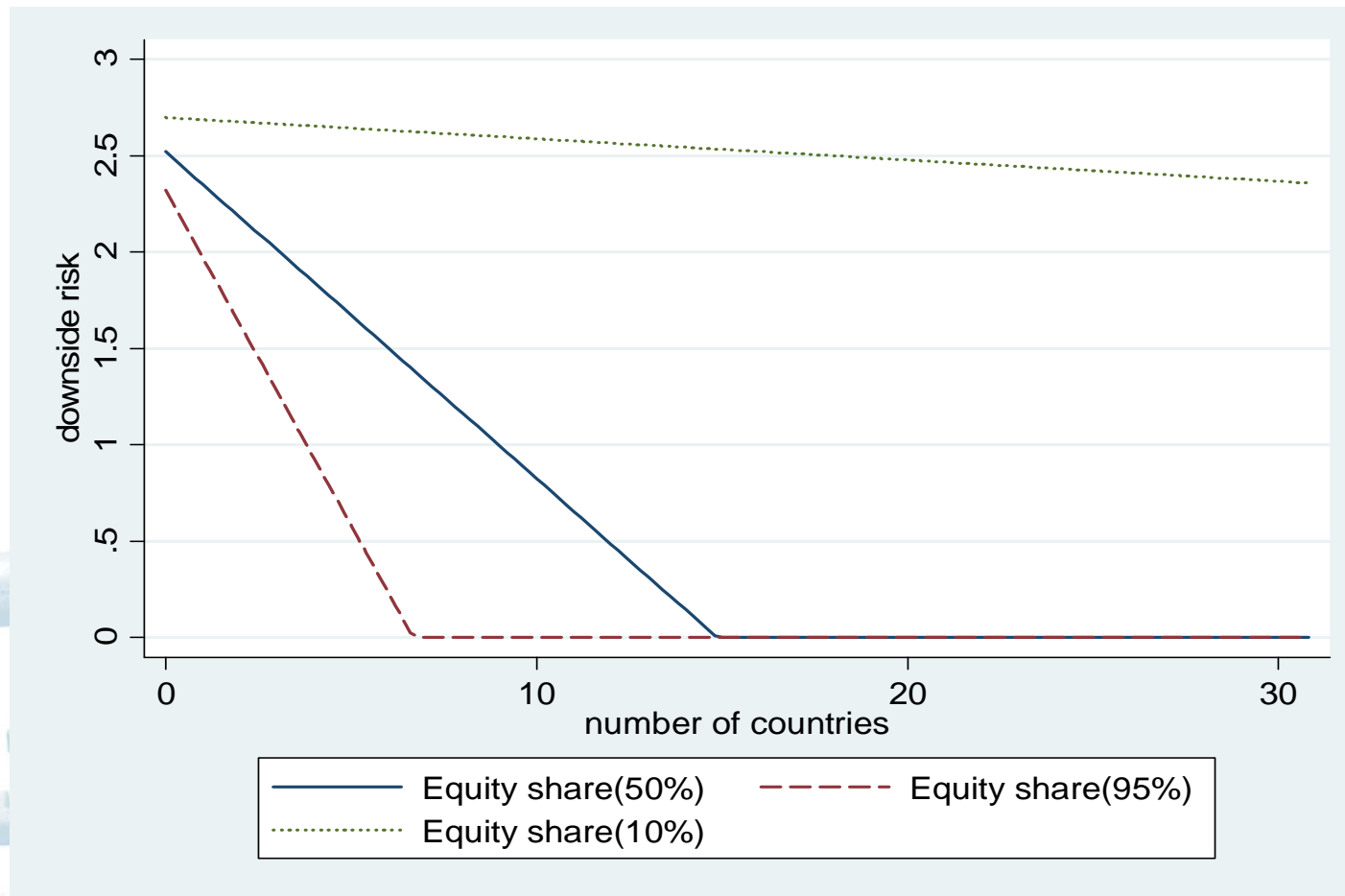# Table 5A Fixed Effects Panel Estimation of Downside Risk

Variables	1 Full Sample	2 High Cost Subadditivity	3 Low Cost Subadditivity	4 Full Sample	5 High Cost Subadditivity	6 Low Cost Subadditivity
Export Intensity	-2.48***	-2.43***	-1.31***	-2.43***	-2.41***	-1.27***
	(0.25)	(0.29)	(0.48)	(0.25)	(0.29)	(0.48)
Firm Size	-0.21***	-0.14**	-0.66**	-0.14*	-0.13**	-0.39
	(0.07)	(0.06)	(0.32)	(0.07)	(0.07)	(0.32)
Organizational Slack	14.25***	7.62***	18.89***	14.22***	7.61***	18.86***
	(0.42)	(0.61)	(0.61)	(0.42)	(0.61)	(0.61)
Tobin's q	-0.14*	-0.36***	0.04	-0.11	-0.36***	0.10
	(0.07)	(0.08)	(0.13)	(0.07)	(0.08)	(0.13)
Product Diversity	-0.17***	-0.18***	-0.28***	-0.09*	-0.17***	-0.03
	(0.05)	(0.06)	(0.10)	(0.06)	(0.06)	(0.12)
International Experience	-0.03***	-0.04***	-0.01	-0.04***	-0.04***	-0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Multinationality				-0.11***	-0.02	-0.25***
				(0.03)	(0.03)	(0.07)
Equity Share						
Equity Share * Multinationality						
Expatriate Ratio						
Expatriate Ratio * Multinationality						
Constant	-2.82***	-0.13	-4.88***	-3.08***	-0.15	-5.76***
	(0.23)	(0.31)	(0.36)	(0.24)	(0.31)	(0.43)
Firm Fixed Effects [a]	Included	Included	Included	Included	Included	Included
Year Fixed Effects [a]	Included	Included	Included	Included	Included	Included
N	10799	5399	5400	10799	5399	5400

Table 5B Fixed Effects Panel Estimation of Downside Risk

| Variables	13 Full Sample	14 High Cost Subadditivity	15 Low Cost Subadditivity
Export Intensity	-2.41***	-2.40***	-1.18**
	(0.25)	(0.29)	(0.48)
Firm Size	-0.15**	-0.14**	-0.42
	(0.08)	(0.07)	(0.33)
Organizational Slack	14.20***	7.52***	19.11***
	(0.43)	(0.62)	(0.61)
Tobin's q	-0.10	-0.37***	0.11
	(0.07)	(0.08)	(0.13)
Product Diversity	-0.11*	-0.18***	0.03
	(0.06)	(0.06)	(0.16)
International Experience	-0.04***	-0.04***	-0.02
	(0.01)	(0.01)	(0.01)
Multinationality	-0.10***	-0.02	-0.22***
	(0.03)	(0.03)	(0.07)
Equity Share	-0.47*	-0.32	-1.80***
	(0.28)	(0.35)	(0.67)
Equity Share * Multinationality	-0.11	-0.04	-0.38*
	(0.09)	(0.10)	(0.23)
Expatriate Ratio	-0.67	0.46	-3.35***
	(0.53)	(0.72)	(1.29)
Expatriate Ratio * Multinationality	-0.57***	-0.63***	-1.30**
	(0.19)	(0.21)	(0.54)
Constant	-3.03***	-0.08	-5.89***
	(0.25)	(0.31)	(0.46)
Firm Fixed Effects [a]	Included	Included	Included
Year Fixed Effects [a]	Included	Included	Included
N	10799	5399	5400
Log Likelihood	-20432.5	-8746.0	-10459.4
Log Likelihood Ratio Test (χ^2)			
Expanded model vs. basic model [b]	14.24***	12.22**	26.34***
Chow Test of Coefficient Equality (F-test)			
Multinationality		12.18***	
Equity Share * Multinationality		2.77*	
Expatriate Ratio * Multinationality		3.01*	

FIGURE 2 The Effect of Multinationality on Downside Risk at Different Levels of Expatriate Ratio for the High and Low Cost Subadditivity Subsample
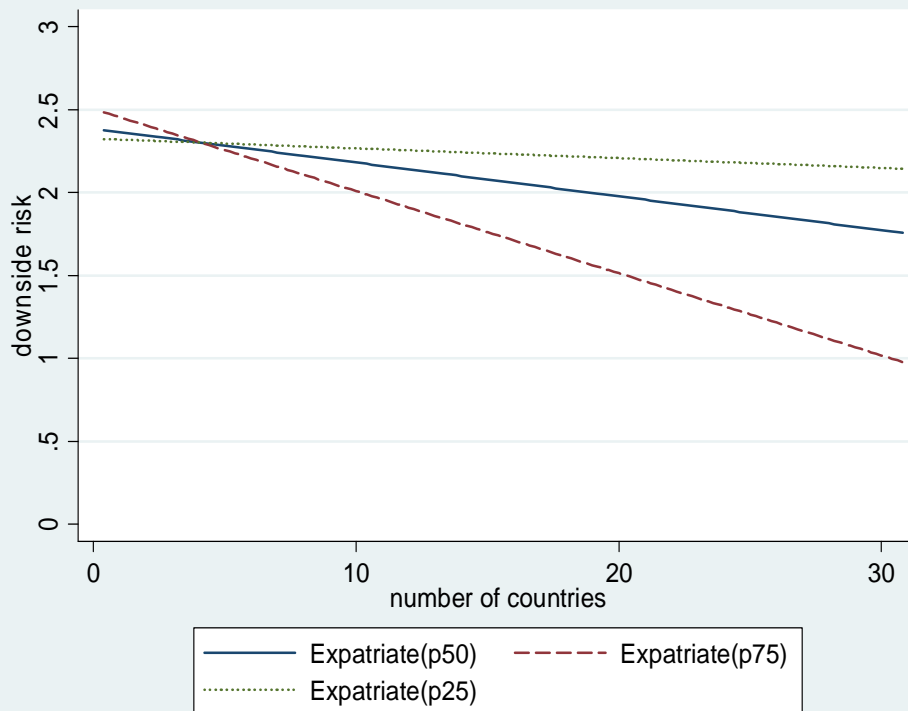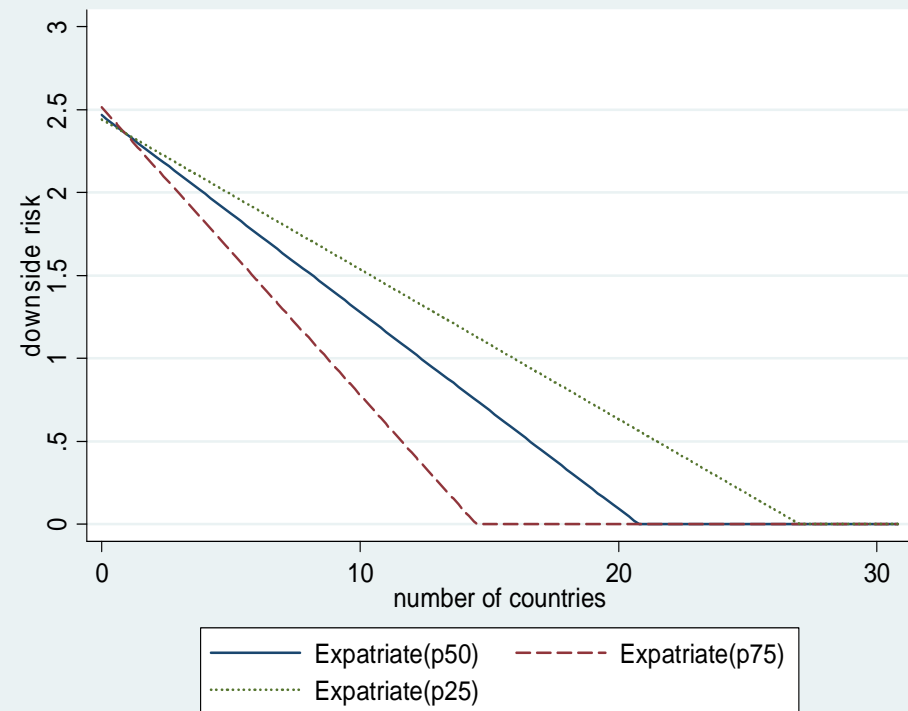
Conclusions

Contributions of the paper:

- Explicit consideration of real options theory's assumptions and boundary conditions in its applications to MNCs: Portfolio sub-additivity and internal organization

- Interaction of host country environmental conditions (affiliate portfolio and host country heterogeneity) and organizational factors (expatriate assignments, equity share) determines downside risk mitigation

    ➢ Explains the mixed findings on real options theory and MNCs in prior studies

- More general implications for research on multinational firms' performance more generally (e.g. Hitt, 1997; Qian, 2010)

    ➢ Should be examined by taking into account characteristics of the *portfolio* of affiliates and host country environments, as well as cross-border organization within the firm

Conclusions II

– Effective control through high equity shares in affiliates is often necessary to achieve operation flexibility

– Dispatching experienced expatriates in different host countries facilitates coordination and exploitation of switching options

  ➤ While this helps to contain downside risk, both operational strategies come at a cost (higher expatriation costs, greater financial investments)

  ➤ Firms have to give balanced attention to containing the downside of multinationality, and benefitting from upside potential

  ➤ *Note:* multinationality with additive affiliate portfolios reduces downside risk, but does not increase overall performance generally

Further research

- Examine roles of more specific organizational processes in affiliates: e.g. control systems, compensation policies, and incentive schemes: case studies or special surveys

- Examine actual shifting by MNEs of production across affiliates in different countries in response to cost changes will provide more *direct* insights. This should include analysis of relevant moderators, among which:

  - Control & coordination (equity stake, controlling positions of expatriates), but also similarity of production facilities / products manufactured, exportability/transport costs of products manufactured, etc.

  - Interesting possible implementation through analysis of METI surveys among Japanese multinationals?: expatriates' positions, detail of products manufactured, export orientation, and value added are available

Thank you for your attention

Comments and questions are welcome